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PRESCRIBED VERSUS ELECTIVE MATHEMATICS IN JUNIOR HIGH SCHOOLS*

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1. Assume the existence of a large (1,600-pupil) junior high school, well staffed and amply supported, receiving all seventh and eighth grade pupils, and also all retarded pupils over 12 years of age. Assume that such a school makes no attempt to give specific training for any vocation or group of related vocations, but offers "vocationally flavored" courses, if thereby it can better motivate specific branches of the cultural, civic, and physical education (the components of general or liberal education) which are its primary concern.

2. It is possible, practicable, and desirable for such a school to offer a variety of one or two-year courses in mathematics, as for example:

a. A "stiff" two years' course in advanced arithmetic along lines of seventh and eighth grade work still traditional in many schools and textbooks.

b. One-year courses respectively in fairly "pure" algebra and plane geometry, slightly simplified from current high school standards in these subjects.

c. A one or two years' course in "composite" mathematics, incorporating the more vital and significant phases of arithmetic, algebra, geometry, etc., as suited to selected groups of the learners concerned.

d. A one or two years' course in applications of arithmetic and other mathematics subjects to the broad field of home-making.

e. A one or two years' course in applications of mathematics to the more common fields of work in mechanical shops.

f. A one or two years' course in applications of arithmetic (and possibly samples from other fields) to the more common commercial occupations and transactions.

g. A one year's course in constructive geometry.

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* Digest of an address before the New York Section of the Association of Teachers of Mathematics in the Middle States and Maryland, December 2, 1921.

h. A half course each year or grade devoted to reviewing, and giving new practical application to the "consumers" arithmetic learned by all normal pupils during the first six grades.

i. A one year's course in "advanced consumers' arithmetic" (beyond sixth grade standards).

j. Theoretically, a one year's course in "appreciational" mathematics corresponding to appreciational courses in music, poetry, graphic arts and general science.

3. All of the courses suggested above are "good" for society. Each one is "good," perhaps very good, for some class or type of junior school pupils. Some of them would certainly be of very little profit for certain other types of pupils. Possibly it would be educationally wicked to try to force some types of pupils to take certain of these courses.

4. Our assumed school contains some pupils of very low, some of very high, and many of modal abilities, general or even mathematical. It contains some from very poor environments, some from excellent environments, many from "fair American" environments. Some of its pupils will go through college, some will leave within two months after their 14th birthday, many will spend a portion of their time between the ages of 14 and 17 in some form of school, but with diminished purposiveness and educational effect.

5. The actual "case groups" which are the concern of educators who would, first, devise best possible curricula to meet "varying needs" (individual and societal) and, second, so administer these curricula as best to serve these needs, "cut across" the above classifications. For example, of pupils of low abilities some come from poor environments and may be expected to leave school early, whilst some come from prosperous environments and may be expected to attend school many years. Some pupils from poor homes will have very keen minds and strong working dispositions, but under present economic conditions they can have no serious expectations of even finishing high school, to say nothing of entering higher institutions. A large proportion of the best minds from the good environments will pass through liberal arts and professional colleges.

6. In view of the varieties of "case groups" in the school and the varieties of courses practicable to be offered, the school authorities are confronted by these problems:

a. Should *all* pupils be required to take in common certain work in mathematics? Why? If so, what?

b. Should *all* be required to take specified amounts of mathematics, choosing, under advice, from the various courses offered?

c. Should *all* pupils be permitted to elect, with advice of teachers and approval of parents, *much, little,* or *no* work in mathematics?

d. Should all be permitted to elect to take, or not to take, courses, subject to the condition that for admission to subsequent higher general, or specific vocational schools specified courses in mathematics will be required?

e. Shall certain pupils under specified conditions be prohibited from entering upon certain courses?

7. Contrary to much superficial educational opinion, the solutions of these problems do *not* rest alone upon assumptions or facts as to the *educational values* of the various mathematics courses for various typical groups of learners. The solutions are to be reached only through study of the *comparative* educational values of the many subjects now known to be available for junior high school curricula, the mastery of the total number of which would require several times the available time and learning energy of any pupil, even a brilliant one.

Each one of the courses suggested above is good, and each would, possibly, be good for all the pupils, if competing courses of greater value in other fields were not available. In actual curriculum making it will increasingly be a problem, not whether an advanced course in arithmetic, or a course in algebra, is "good" or "important" for a stated group of learners, but rather is it *as good,* or *as important,* as the modern language, music, English grammar, oral composition, general science, physical training, current events, civics, world history, drawing, industrial arts, household arts, geography, hygiene, general literature, vocational guidance or scouting, one or more of which must be omitted if such mathematical course is imposed or elected?

8. Who shall decide as to *relative educational values* of subjects available in given types of schools? Educational administrators have allowed specialist advocates with their *ex parte* pleadings, to play too large a part in determining curricula. The results are jumbles of compromises, giving the balance usually in favor of the strongest advocate, or else resulting in hopelessly congested curricula. A mathematician, like a musician, a geographer, a historian, a graphic artist, a business man, a home economics specialist, or a sociologist, is an expert in the content and technique of his field, and *sometimes* he is an expert in its *educational values* as a subject of study for stated groups of learners. But as an expert in the *relative* or *comparative* educational values of the various subjects that should, for stated groups of learners make up a *balanced school diet*—is he not as poorly equipped as any layman? What does the typical mathematician think of the "claims" of the musician, as to the educational values of his subject? And how does the latter reciprocate? And what does the geographer think of both of them? And how does the typical "English" specialist regard all three?

9. The educational authorities presupposed above finally establish a "jury" on educational values to advise them. This jury is composed of a superintendent of schools, a man with long experience as a junior high school principal, a social economist who has given much attention to the conditions of juvenile workers, an all-around business man, and a high school principal. That jury, after hearing various specialists in subject matter fields, a couple of psychologists, and some one who has made special studies of the careers and conditions of various classes of pupils after leaving school (cultural, civic, physical, and vocational), would, in the estimation of the present writer, endorse these solutions of the problems stated above:

a. No uniform course in mathematics should be prescribed in *common* for all pupils in seventh or eighth grades.

b. Too little is as yet known of the relative values of mathematics to justify us in requiring all pupils to take some course or courses. Hence, if pupils of certain classes desire, with the approval of their parents, to omit all mathematical studies during one or both of these grades, they should be permitted to do so, provided they give evidence from time to time that the *consumers* arithmetic learned in the first six grades remains vitally functional, and provided that they pursue a full curriculum of other important courses.

c. Too little is yet known of the relative values of subjects, other than mathematics, to justify us in barring pupils from mathematical courses, except where a certain course is purposely designed only for learners of specified high grades of ability which the candidates in question do not possess.

d. As far as the imperfect powers of prophecy found among *ex officio* advisers permit, seventh and eighth grade pupils and their parents should be urged to give from ten to fifteen per cent of their school time to those mathematical courses, which, coming within their present probable abilities, are supposedly most nearly related to their probable future (not present) needs and interests. (But educators are under obligations to substitute knowledge for aspiration and belief as to what, for given vocations, higher studies, and consumers, actually are those future needs, differentiated somewhat perhaps among several ability or sumptuary levels.)